AIRRMONIA

OPERATION AND

TECHNICAL MANUAL

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Master Register Number: MRN-053
Dated: December 2010
Issue No: 9.1

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AMENDMENT RECORD SHEET

Issue No	Date	Revised Section(s)	Revised Page No(s)	Authorised
Preliminary	July 2001			H.E. van Dijk
1	Aug 2001	All	All	H.E. van Dijk
2	Nov 2001	All	All	H.E. van Dijk
3	Jan 2002	Section 14 New section	Section 14.2 and 14.3 Index	H.E. van Dijk
4	May 2002	Section 9	Section 9	H.E. van Dijk
5	August 2003	Section 2, 4,5 and 9	The complete sections	H.E. van Dijk
6	November 2004	All	All	H.E. van Dijk
7	July 2006	Section 5, 14,		H.E. van Dijk
8	November 2007	See history list		H.E. van Dijk
9	February 2008	Section 4.3		H.E. van Dijk
9.1	December 2010	Section 9.3.1	K factor calculation corrected	H.E. van Dijk

HISTORY OF THE MANUAL

Date	Issue	Changes	Authorised
July 2001.	Preliminary	Start manual to build for scratch	H. E van Dijk
Aug 2001	Issue 1	Spelling and layout adjustments Corrections in section 6 & 7 New drawings section 14	H. E van Dijk
Nov 2001	Issue 2	Latest Update on the photo's Corrections in section 2.3 Corrections in section 3 Corrections in section 5 Corrections in section 9 Corrections in section 11 Rewritten section 13	H. E van Dijk
Jan 2002	Issue 3	Add Index Section 14 Drawing Computer board and Valve PC control board	H.E. van Dijk
May 2002	Issue 4	Change make up of section 9 New drawings section 14	H.E. van Dijk
August 2003	Issue 5	Section 2. Small corrections in the introduction Section 4 new labels are issued Section 5 Key board add new menu structure for software version 1.09 Auto calibration Section 9 Getting started and auto calibration	H.E. van Dijk
November 2004	Issue 6	Revision Mechatronics house style Corrections in all sections	H.E. van Dijk
July 2006	Issue 7	Section 5 Update the menu layout Remove appendix H Flow diagram Update drawing measure principal appendix F Section 14 add drawing AMIN100065	H.E. van Dijk
November 2007	Issue 8	Section 2.3.1. Part number change AMIN010008 for AMIN010015 Section 6.1. Take off all tubing Section 6.2. Take off all tubing and changed part number AMIN010008 for AMIN010015 Section 7.1. Take off all tubing. Section 8.6. is removed. Section 9.2.1. removed the instrument will settle…. Section 9.3.1. The formula $TCC_{50} = (TCC_{500} - TCC_0)xK - TCC_0$ Corrected by $TCC_{50} = (TCC_{500} - TCC_0) + K - TCC_0$	H.E. van Dijk

		Section 9.3.3. Detector 2 must be in the same range as Detector 1 plus 60 till 200 mV. Detector 2 must be in the same range as Detector 1 plus 60 till 200 mV. Sections 9.3.4. and 9.3.5. removed detector 1 must…. and the Tcc is …. Section 11.1.2. removed 750 hour maintenance	
February 2008	Issue 9	Section 4.3 Prepare 50 ppB calibration liquid. Correction on preparation 50ppB 10 parts must be 9 parts	
December 2010	Issue 9.1	$TCC_{50} = (TCC_{500} - TCC_0) + K - TCC_0$ corrected by $TCC_{50} = (TCC_{500} - TCC_0) * K + TCC_0$	

CONTENTS

Contents Page No.

AMENDMENT RECORD SHEET VII
HISTORY OF THE MANUAL VIII
CONTENTS 10
1. INTRODUCTION 13
1.1. SYSTEM OVERVIEW 13
2. INSTRUMENT DESCRIPTION 16
2.1. AIRRMONIA 16
2.2. TECHNICAL SPECIFICATION 16
2.3. TOOLS AND ACCESSORIES 17
2.3.1. Part list 17
3. INSTALLATION 18
3.1. PRE INSTALLATION 18
3.2. FIELD INSTALLATION 18
4. REAGENTS 19
4.1. STORAGE 19
4.2. CONTAINERS 19
4.3. PREPARE THE 50 PPB CALIBRATION LIQUID. 19
4.4. LABELS 20
5. KEYBOARD 21
5.1. MENU STRUCTURE AIRRMONIA 22
5.2. MENU ITEMS 24
6. DETECTION BLOCK 25
6.1. REPLACEMENT OF THE ION EXCHANGE COLUMN 25
6.2. REPLACEMENT OF THE MEMBRANE 26
6.3. REPLACEMENT OF THE TEMPERATURE SENSOR 27
6.4. REPLACEMENT OF THE DETECTOR SENSOR 27
7. SAMPLE BLOCK 28
7.1. REPLACEMENT OF THE MEMBRANE 28
8. SYRINGE PUMP 30
8.1. DESCRIPTION OF THE SYRINGE PUMP 30
8.2. REPLACEMENT OF THE SYRINGE 31
8.3. REPLACE THE TEFLON TIPS 31
8.4. ADJUSTMENT OF THE SENSORS 31
8.5. ADJUSTMENT OF THE SYRINGE STROKE 31
9. GETTING STARTED 32
9.1. PRE INSTALLATION 32
9.2. START-UP THE INSTRUMENT 32
9.2.1. Step one 32
9.2.2. Step two 33
9.3. CALIBRATION PROCEDURE 33
9.3.1. Automatic calibration 33

9.3.2. Service calibration 35
9.3.3. Calibration of blank value 35
9.3.4. Calibration of 50 ppB value 36
9.3.5. Calibration of 500 ppB value 36
9.4. MEASUREMENT START 37
9.5. MEASUREMENT STOP 37
9.6. SETTING / SERVICE 38
9.6.1. Settings 39
9.6.2. Service 40
10. SYSTEM MESSAGES 41
10.1. SYSTEM MESSAGES 41
10.2. ERROR MESSAGES 41
11. MAINTENANCE 42
11.1. MAINTENANCE TIME SCHEDULE 42
11.1.1. <150 hour 42
11.1.2. 1500 hour 42
11.1.3. 2100 hour 42
11.1.4. 4500 hour 42
11.1.5. 8500 hour 43
12. DATA MANAGEMENT 44
12.1. RS232 CONNECTION 44
12.2. DATA STORAGE 44
12.3. DOWN LOAD DATA 44
12.4. PROCESS THE DATA 45
13. UPLOAD NEW SOFTWARE 46
13.1. INSTALL THE DOWNLOAD SOFTWARE 46
13.2. INSTALL THE INTERFACE 47
13.3. CONNECT THE INTERFACE TO THE PC BOARD. 47
13.4. RUN THE UPLOAD SOFTWARE 47
14. DRAWINGS 50
14.1. LIQUID FLOW 50
14.2. LIQUID FLOW (PRESS) 51
14.3. CONNECTORS ON THE COMPUTER BOARD 52
14.4. MOTOR AND VALVE PC CONTROL BOARD. 53
15. APPENDIX SECTION OF MRN-053 AIRRMONIA 55
APPENDIX A - CONNECTORS 56
APPENDIX B - PC SERIAL DATA CABLE FOR DOWN LOAD THE DATA 57
APPENDIX C - CONTROL COMMANDS. 58
APPENDIX D - AIRRMONIA DATA STRING FORMAT 61
APPENDIX E - CALIBRATION FORMAT STRING TO THE AIRRMONIA 62
APPENDIX F - MEASURE PRINCIPAL 63
APPENDIX G - MENU STRUCTURE PAGE 1, 2 AND 3 64
ALPHABETICAL INDEX 68

1. INTRODUCTION

The AiRRmonia analyser contains a membrane sampler for quantitative sampling of gas-phase ammonia. After diffusion through the membrane, the ammonia is absorbed in a sampling solution. Ammonium-containing aerosols are not collected in the sampler. The sample solution is pumped continuously through the detector for conductivity measurement after selective membrane diffusion.

1.1. System Overview

The AiRRmonia is installed in an aluminium weatherproof box.
Inside the box you will find a container apartment for the reagent and the waste container. On top of the frame there is the keyboard what give you control of the instrument.

The AiRRmonia can run on the mains 240 or 120 volt and on battery power or even on solar panels. At the backside of the frame, there are the power chassis, the communication connectors, and the toggle switch for the power control.

Photo 1 AiRRmonia

2. INSTRUMENT DESCRIPTION

2.1. AiRRmonia

This instrument is a Gas-phase ammonia-measuring instrument. The unit is user friendly and works with ready to use reagents. This feature gives the instrument good reproducible results over a long period of time. The E-EPROM storage capacity is sufficient to leave the AiRRmonia in the field for 3-week period.

The AiRRmonia has the potential to detect from 0,1µg/ m^3 up to 100µg/ m^3 (preliminary data).

The instrument has a build in 2-points auto-calibration set. The mass Flow Controlled sampling has a flow of 1l/min. The measure period is time controlled and the highest sample resolution is one sample every 1 minute.

2.2. Technical specification

Dimensions	
Length	62 cm
Width	40 cm
Height	50 cm
Weight	25 kg is exclusive the liquid.
Weight for the reagent	1.5 kg for the liquid.
Power supply	90-264VAC 50/60 Hz; 10VA
Battery operated	12 VDC, 8VA.
Real time data	Available every second.
Output RS- 232	19200-8-N-1 default setting.
Selectable	9600-8-N-1 4800-8-N-1

2.3. Tools and Accessories

For maintenance is a standard toolkit with a selection of screwdrivers and hex keys in the range from 2 mm till 5 mm. A cutter for cutting Tie-raps, a pair of scissors and some hand gloves for changing the membrane.
for starting the flow from the bottles into the system use a syringe, (AMIN109003).

2.3.1. Part list

The following part numbers can be order

Order number	Part description
QWLV030014	Diluter Syringe 250 µl
QWLV030015	Diluter Syringe 2500 µl
QWLV030016	Teflon tips for the 250 µl syringe units.
QWLV030018	Teflon tips for the 2500 µl syringe units.
QWLV040001	Air filter
QEPC079001	Upload tool for instrument software
AMIN010015	Membrane for Detection block.
AMIN019006	Resin for the detection block
AMIN020010	Membrane for Sample block.
AMIN039011	Syringe pump motor
AMIN049020	CO2 filter assembly

Table 1 Part list

3. INSTALLATION

3.1. Pre Installation

Before the AiRRmonia can be used for the first time, you have to do a pre set-up of the instrument. In the pre set-up, you have to rinse, fill the tubing and the syringes with reagents from the containers without trapping air bubbles.
To fill the system and do the calibration it will take some time. If everything is done correctly the instrument is ready for use.
For more details, see section **Getting started.**

3.2. Field Installation

To avoid any false measurements in the field do not touch the bottle connectors with your hands. Recommendation is to use hand gloves.

Check all the tube connections and there are no air bubbles trapped in the tubes and/or in the syringes.
Check the levels in the containers. The containers can hold liquid for 6 days. After detection of empty bottle the instrument will stop.
Check the level of the waste container. When the detection ‘waste container full’ the instrument will stop.

Make sure there is a free passes way of air to the air inlet of the AiRRmonia.

Connect the AiRRmonia to the power source, switch on and start the measurement. The instrument will show the first menu in the display.
For details and a full description of the entire menus, see section **Getting started & Keyboard**.

4. REAGENTS

There is no need for mixing the fluid; the reagents are ready for use.

4.1. Storage

Store the regent in a 4 - 8 °C cool place.

4.2. Containers

The following reagents are supplied in bottles for the AiRRmonia

QRR029001	De-mineralised water	0.25 L
QRR029024	De-mineralised water	1L
QRR029025	De-mineralised water	10L
QRR029002	Sodium Hydroxide solution	0.25L
QRR029022	Sodium Hydroxide solution	1L
QRR029026	Standard 500 ppB ammonium	0.25 L
QRR029027	Standard 500 ppB ammonium	1L
QRR029028	Standard 50 ppB ammonium	0.25 L
	Waste container	2.5 L

4.3. Prepare the 50 ppB calibration liquid.

To make the 50 ppB solution, take 1 part of the 500 ppb and 9 part of de-mineralised water and mix well.
The 50 ppB solution has a short expire date. Prepare the 50 ppB when needed for the calibration.

4.4. Labels

The containers have the following labels:

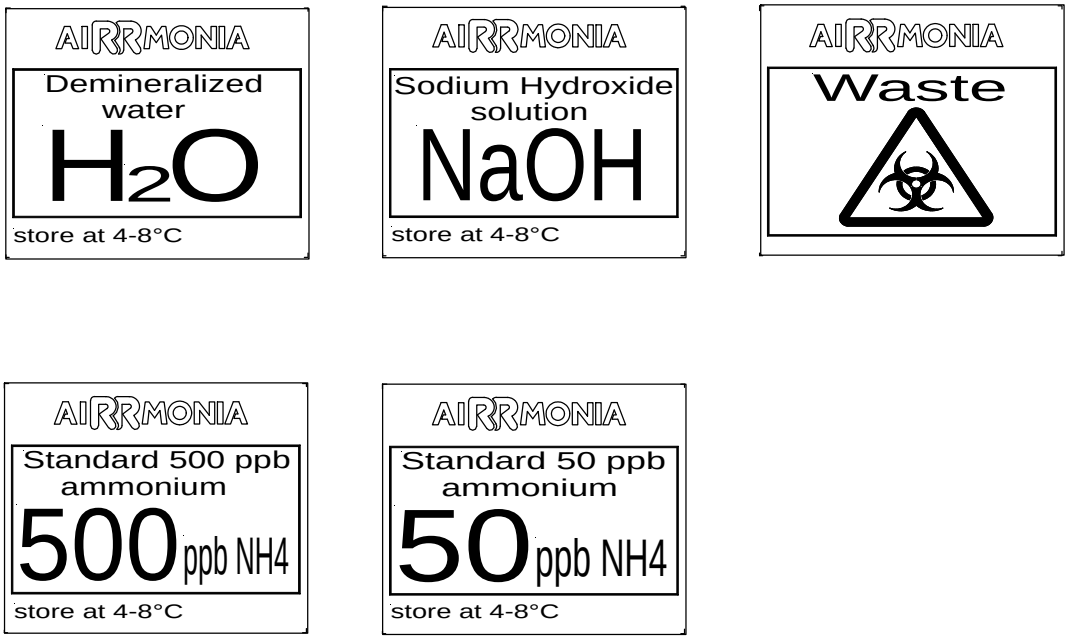
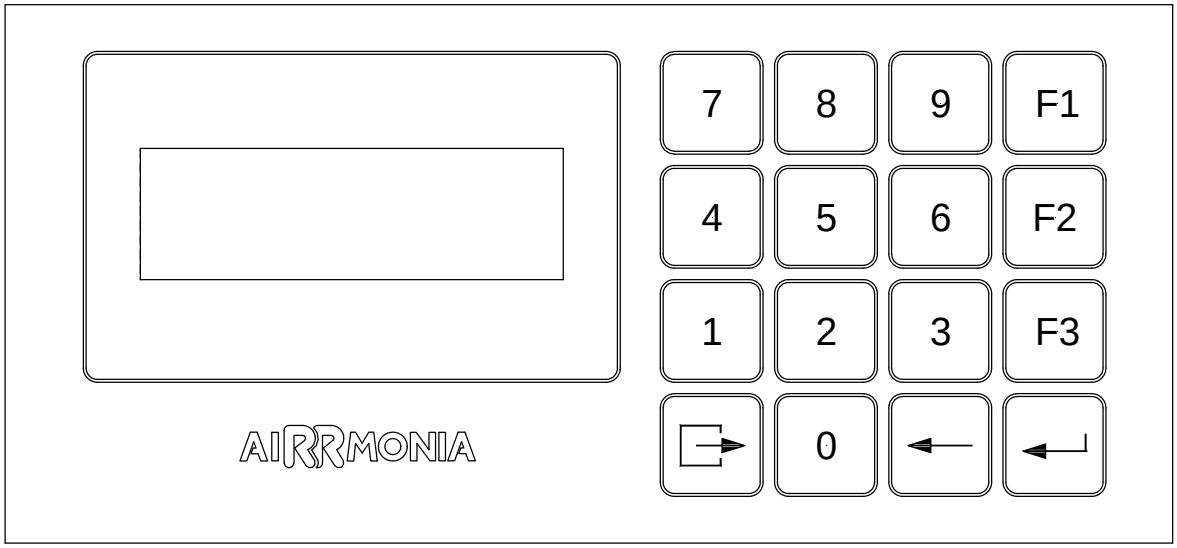


Figure 1 Stickers

5. KEYBOARD



Function key 1

Function key 2

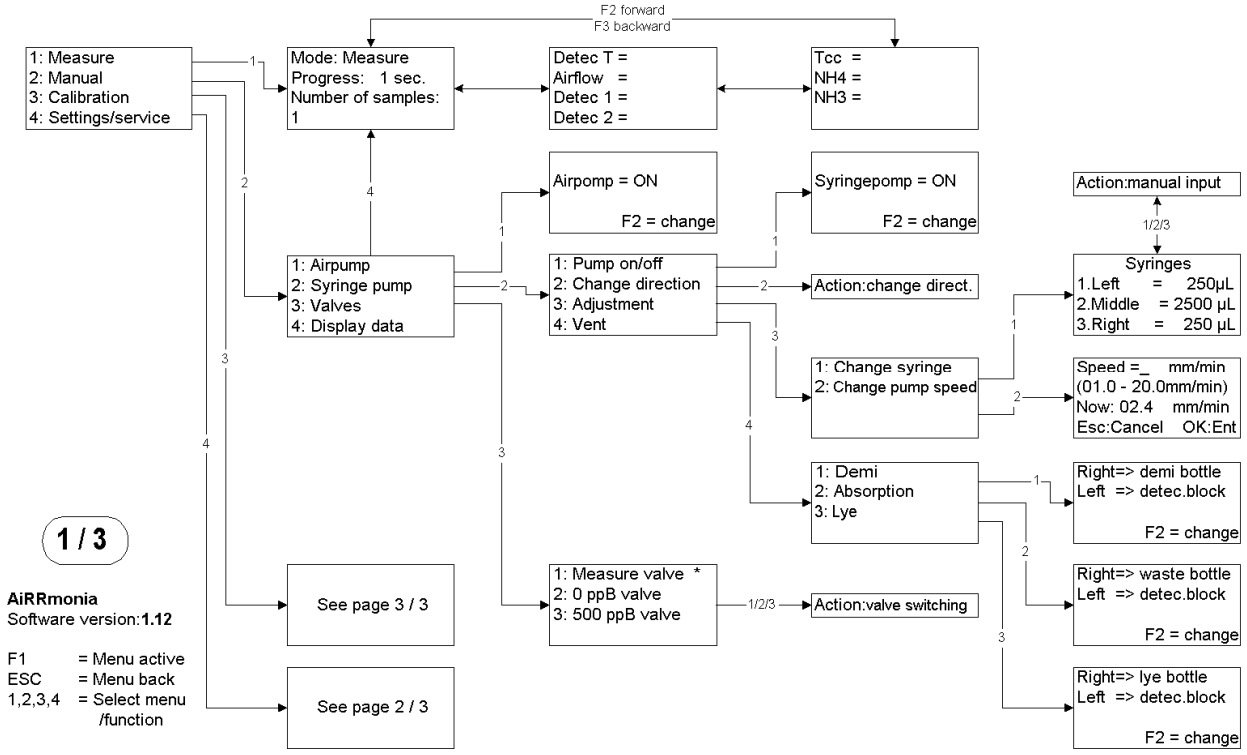
Function key 3

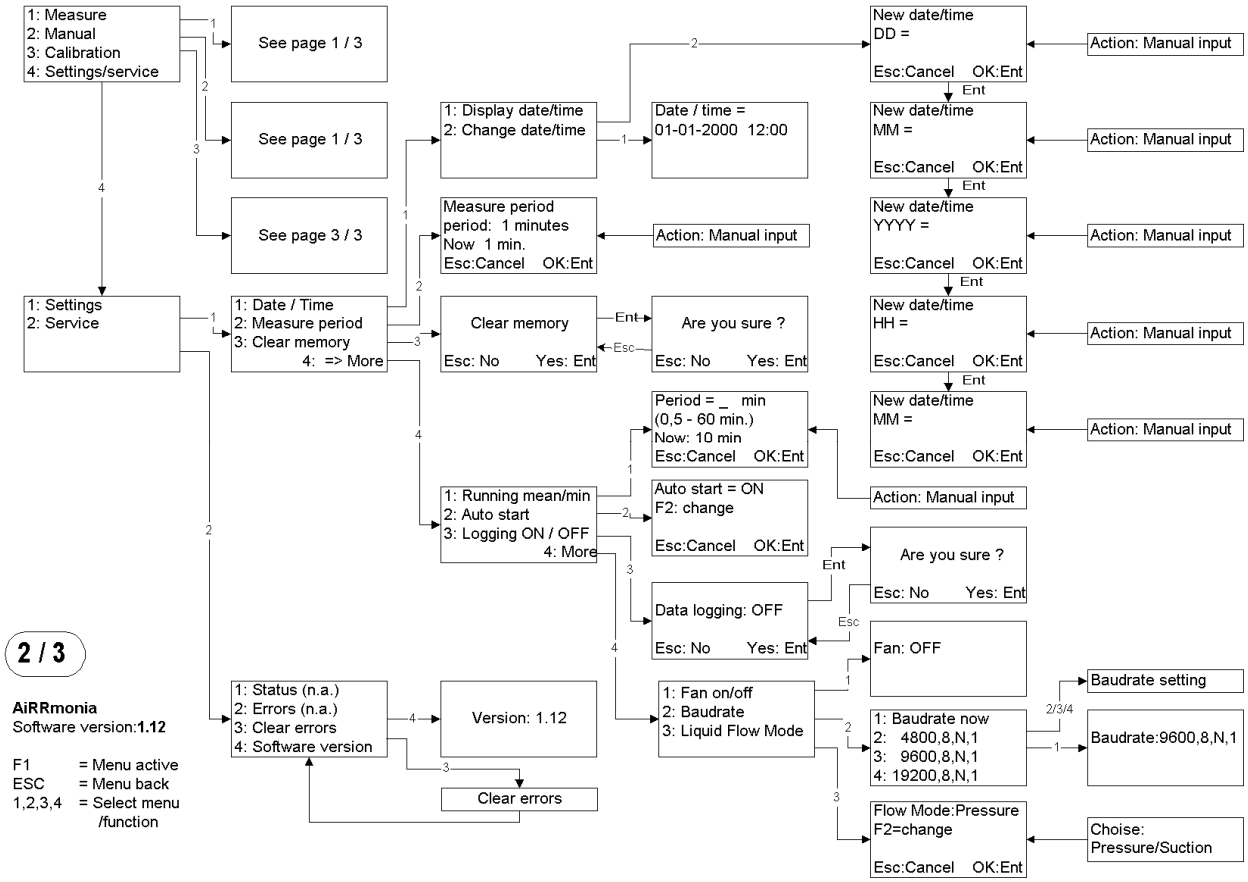
Escape key

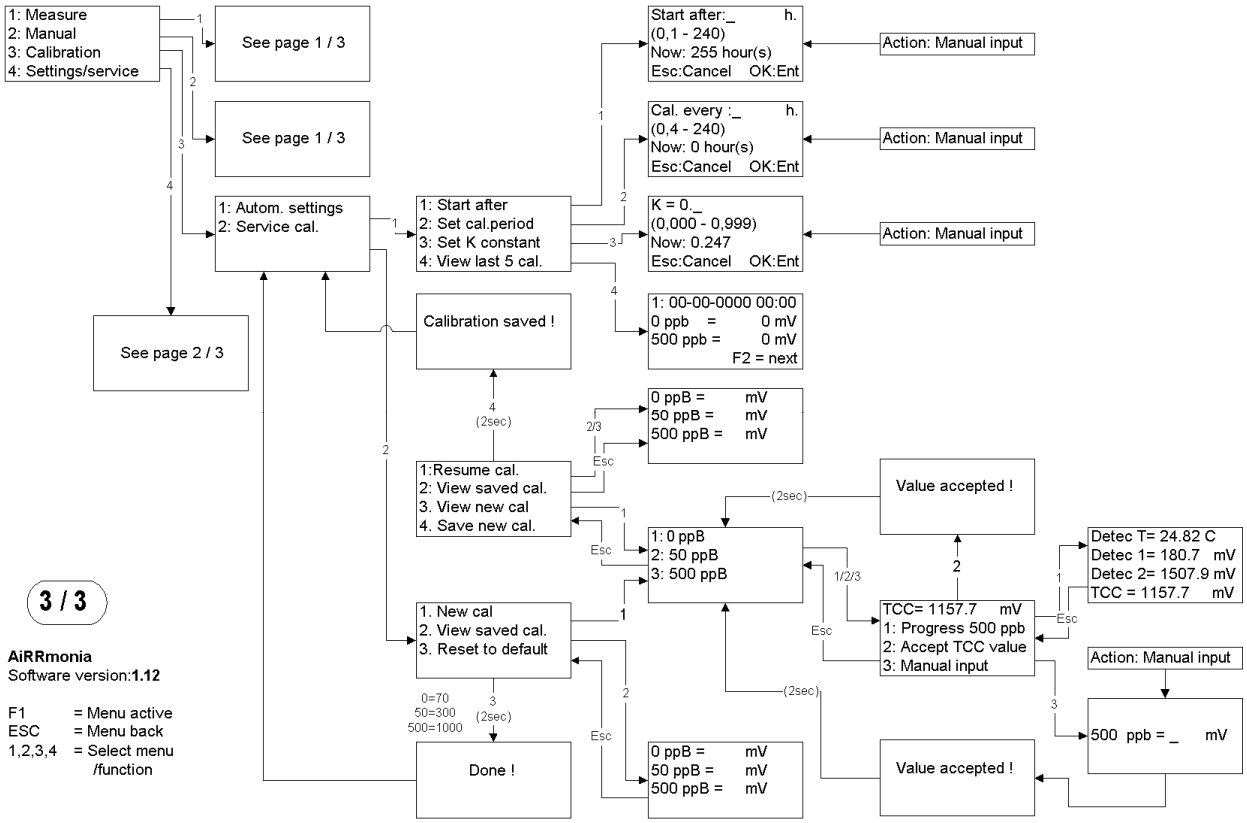
Back space

Enter key

5.1. Menu structure AiRRmonia







Note: There is an A4 sized page in the appendix **Menu Structure**

5.2. Menu items

Navigating through the menu's
During normal operation, the main menu is displayed. To access submenus and functions, press the item number shown at the front of the line.
Press **ESC** to return to previous menus and to abort functions.
Function keys **F2** and **F3** are reserved for future purposes.

The submenus are listed with menu number (see overview in section 5.1)
The legend is;

[Bold text]	Bold text in line the display
Menu (4-1)	Use the number keys 4 and 1 to go to the menu
<F2>	Press the function key F2

Menu (4-1-4-1) means the following keystrokes:
Key 4 **[Setting/Service]**
Key 1 **[Settings]**
Key 4 **[More]**
Key 1 **[Running mean/min]**

6. DETECTION BLOCK

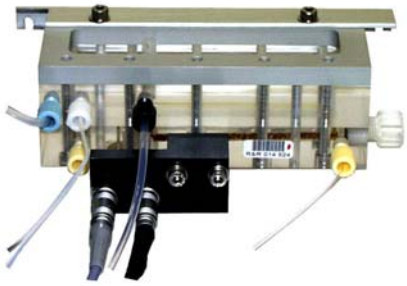


Photo 2 Detection block

6.1. Replacement of the Ion exchange column

Replacement of the ion column must be done in a proper accommodation.
First, change the Ion exchange column before you change the membrane.
Take the Detection block out of the instrument.

The best way;

- Disconnect to bottle from the system
- Take off all the tubing from the detection block.
- Disconnect the two connectors. (Temperature sensor and the detector sensor)
- Take out the Detection block by loosing the two hex screws.

Take the Detection block in front of you. Turn the detection block so you have access to the filling cap of the Ion exchange column. Unscrew the cap and suck carefully the old Ion exchange column out of the block by using a syringe. Be careful not to loose the two glass filters.

Fill the Ion exchange column with the new resin by using a syringe AMIN019006. Be careful when you fill the tube and watch the two glass filters that they are still in place. Replace the cap and close it careful, the remaining liquid has to find his way through the filters to the membrane.

Replace the Detection block or start to change the membrane.

6.2. Replacement of the membrane

Replacement of the membrane must be done in a proper accommodation.
Before you replace the membrane, check if you want to change the ionisation. The best sequence is first the ionisation, then the membrane. See the above section for instruction for replace the ionisation.

The best way;

- Disconnect to bottle from the system
- Take off all the tubing from the detection block.
- Disconnect the two connectors. (Temperature sensor and the detector sensor)
- Take out the Detection block by loosing the two hex screws.

Now you have the Detection block in front of you.

Turn around the block and remove the 10 screws.
Turn the block tentative around again and hold the sections of the block together.
Between the membrane and block, there are two glass filters and we don't want to loose them.
Take off the plastic upper part.
Remove the old membrane and please think about the two glass filters.
The best way to handle the new membrane is to use hand cloves. This is to prevent any touch with the membrane to avoid any false measurement in the field.
Clean the top block with water.
Dry the block.

- Take the new membrane out of the bag. **AMIN010015**
- Place the new membrane; make sure there are no hairs or dust on the block.
- Replace the plastic upper part, turn the Detector block and replace the screws.
- **First** tie the screws **hand** tied.
- Tie the screws gentle in a cross over movement (See table). First start at number 1 and tie this screw next is number 2 etc. By doing this we divide the pressure equal over the metal block. Do not over do the tiding of the screws because all the force will be in the plastic block. By over doing this you take a risk that the sample block will cleave after a while. You can use a torsion spanner with a moment of 100 Ncm to tie up the screws. If everything went well, you can see along the edge a slightly colouring of the white colour of the membrane.

Number of crossing	1	7	9	3	6
Screws in the block	O	O	O	O	O
Screws in the block	O	O	O	O	O
Number of crossing	5	4	10	8	2

Sequence of cross movement of the screws

- Replace the Detector block in the instrument and connect the two connectors and the tubing in the correct places.

6.3. Replacement of the temperature sensor

This is a manufactory job. Please return instrument to Mechatronics.
Order a replacement for the Detector sample block.

6.4. Replacement of the Detector sensor

This is a manufactory job. Please return instrument to Mechatronics.
Order a replacement for the Detector sample block.

7. SAMPLE BLOCK

Photo 3 Sample block

7.1. Replacement of the membrane

Replacement of the membrane must be done in a proper accommodation.

The best way is;

- Disconnect the bottle from the system.
- Take off al the tubing the valve block.
- Take off the input tube with number 1 from the sample block.
- Take off the tube with the filter from the mass flow control unit.
- Make loose the valve unit by unscrewing the two hex screws. The valve unit is hanging loose in the instrument.
- Take out the Sample block by loosing the two hex screws and shift in the slot and take it out the instrument.

Now you have the Sample block in front of you with filters connectors on both sides.

- Turn around the block and remove the 10 screws.
- Take off the heavy metal plate.
- Remove the old membrane.
- Clean the block with water.
- Dry the block.
- Take the new membrane out of the bag. **AMIN020010.**
- The best way to handle the new membrane is to use hand cloves. This is to prevent any touch with the membrane to avoid any false measurement in the field.
- Place the new membrane; make sure there are no hairs or dust on the block.
- Replace the metal block and put the screws back.
- **First** tie the screws **hand** tied.
- Tie the screws gentle in a cross over movement (See table). First start at number 1 and tie this screw next is number 2 etc. By doing this we divide the pressure equal over the metal block. Do not over do the tiding of the screws because all the force will be in the plastic block. By over doing this you take a risk that the sample block will cleave after a while. You can use a torsion spanner with a moment of 100 Ncm to tie up the screws. If everything went well, you see along the edge a slightly colouring of the white colour of the membrane.

Number of crossing	1	7	9	3	6
Screws in the block	O	O	O	O	O
Screws in the block	O	O	O	O	O
Number of crossing	5	4	10	8	2
Sequence of cross movement of the screws					

Now replace the Sample block in the instrument.
Connect the tube with the filter on the mass flow block and the tube with number 1 to the sample block. Replace the valve block and connect the tubing in the correct place. Tube number 14 is at the bottom location and tube number 13 is at the top location. Tie the screws of the valve block. Do not over do this because it is plastic. Tie the now the screws of the sample block.

8. SYRINGE PUMP

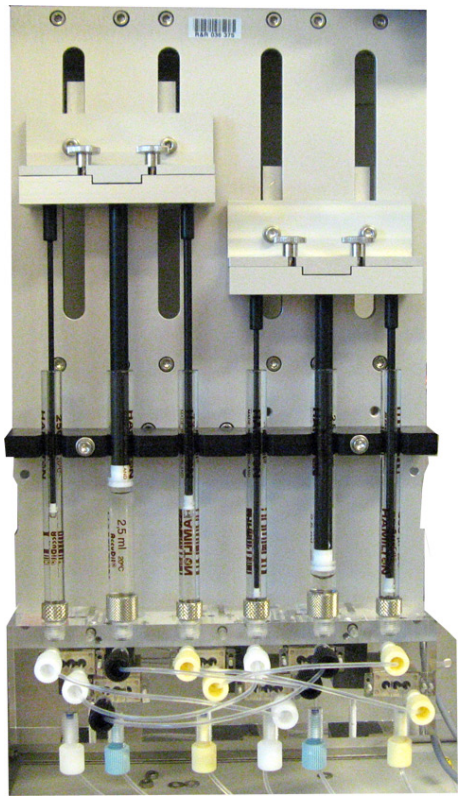


Photo 4 the Syringe pump.

8.1. Description of the Syringe pump

The syringe pump consists of 2 times three syringes in a row. We have two type of flows trough the system a waste and a measure flow.
The syringe works in two directions, one direction is the sucking phase and the other direction is the compress phase. The sucking stroke is, when the syringe piston moves from the bottom end to the top. The other way around is the compress stroke, when the syringe stroke moves from the top end to the bottom.
The sucking stroke is taking the liquid out of the bottles. The compress stroke is pressing the liquid to the Sample and Detection block and the waste to the waste container.

With two sets of syringe, we have a constant flow of liquid through the sample and detection block by moving the "pump engine" in an up/down sequence. A set of control valves switch the liquid direction to the compress stroke or to the sucking stroke.

8.2. Replacement of the Syringe

Unscrew the two screws from the attachment block. Unscrew the syringe from the syringe block. Click the syringe out of the holder by using some force. Beware of the rubber ring in the syringe block. Place the new syringe on the syringe block and refit the attachment block.

8.3. Replace the Teflon tips

First, take the syringe out the "pump engine" as described in section **Replacement of the syringe**.

1. Take the piston out of the syringe
2. Cut the Teflon tip of the plunger with a sharp knife. Be careful not to damage the metal plunger
3. Replace the old tip for the new tip assembly
4. Moisten the tip with water to ease the tip back into glass syringe barrel
5. Replace the piston in the syringe and set the unit back in the "pump engine".

8.4. Adjustment of the sensors

Those adjustments are done by Mechatronics in the factory. There is no need to make adjustments in the field.

8.5. Adjustment of the syringe stroke

This adjustment is done by Mechatronics in the factory. There is no need to make adjustments in the field.

9. GETTING STARTED

9.1. Pre installation

Place the Bottles in the container apartment and connect the right bottle to the correct bottle adapter plug. (See bottle connection in section **Drawing**). Use hand gloves to avoid hand contact with the tubing of the bottle adapters to avoid false readings in the flied.
To get the liquid out of the bottle use syringe AMIN109003 with a soft tube at the end and suck the liquid out of the bottle. The rest is done by gratify fill and time, it will take some time before the instrument is filled up with the liquid without air bubbles trapped in the tubing.
If air bubbles are trapped in the system use the **[Vent option]** in Menu (2-2-4). Check in which circuit the air is trapped select the circuit and change the direction of the pump as many times till the air is out of the system.

9.2. Start-up the instrument

Connect the instrument to the mains and switch ON.
First we clean the instrument by starting the liquid flow through the syringe pump and the tubing.

9.2.1. Step one

The instrument is switched on and the display shows the main menu.
Go to **[Pump on/off]** Menu (2-2-1) and press **<F2>**. This action start the liquid flow through the system Go to **[Display data]** Menu (2-4) and monitor the value of the Detector 1 and Detector 2. The F2 and F3 keys toggle you through the data displays to view the data.
Check the temperature is in the range of the outside temperature plus or minus 2 or 3 degrees. If those values are present in the data display we the instrument is ready for the next step.

9.2.2. Step two

Switch on the air pump.
Return to the main menu by pressing the **<ESC>** key. Switch on the **[Air pump]** Menu (2-1). This is a toggle function; pressing F2 the pump is **on** and press F2 again the pump is **off**.
Return to the display to view the data Menu (2-4). Check the increase of the voltage on Detector-2. Next check is the airflow this must be 1 litre/minute.
Press **<ESC>** key until you reached the main menu. Select now **[Measure]** Menu (1) and use the F2 or the F3 key to toggle through the data display and check the airflow value.
There is now airflow through the instrument and this flow has effect on the value of the
Detector-2. In about 10 minutes you will see a increase of the Detector-2 value. If this is in order the instrument is ready for calibration. Switch the **[Air pump]** Menu (2-1)

9.3. Calibration procedure

9.3.1. Automatic calibration

Parameter settings

Menu (3-1-1) **[Start after]**
This value shows after how many hours the instrument will start to do the next automatic calibration. Hours are show in whole numbers in the range 1 …240. When select 0 no calibration will be is done.

Menu (3-1-2) **[Set cal. Period]**
The value shows the waiting period between the next automatic calibration.
Example:
If the number is 5 the next calibration will start after 5 hours.

Menu (3-1-3) **[Set K constant]**
Factor K is used for the 50 ppB calibration value according the following formula:

$$K = \frac{TCC_{50} - TCC_0}{TCC_{500} - TCC_0}$$

$$TCC_{50} = (TCC_{500} - TCC_0) * K + TCC_0$$

The K factor is established on 0.247.

The Zero calibration takes 120 minutes.
A new value of the TCC_0 will be accepted if the numbers are in a range of 1 and 300. If the values are not in the range the last calibration figures will be used.

The 500 calibration takes 120 minutes
A new value of the TCC_{500} will be accepted if the numbers are in a range of 500 and 2000. If the values are not in the range the last calibration figures will be used.

The TCC will be the mean calculated value for the set-up period what is set in Menu (4-1-4-1) **[Running mean/min.]**

9.3.2. Service calibration

We have to do 3 calibrations
1. Find the blank value
2. Find the 50 ppB value
3. Find the 500 ppB value

To perform this calibration we select the **[Service cal]**. Menu (3-2)
Use the **<ESC>** key to return to the Main menu.
Select **[New cal]** Menu (3-2-1). Select which one of the value you want to calibrate, Start logging , and observe the raw data in *Progress* or see in *New value* your new Tcc value. If you values of the Tcc are in your acceptation press 2 in Menu (3-2-1-1/2/3) to accept the new value. There is an option in this menu to put a manual value in for that calibration range.
After all calibrations are done, press **<ESC>** and select *Save new calibration.* Now the instrument is ready for use with the new set of calibration values.
Be aware as soon you out of the menu 14 structure the calibration is stopped. If this happened you have to restart the calibration for one of the values.

9.3.3. Calibration of blank value

Select **[0 ppB]** Menu (3-2-1-1). In **[Progress 0 ppB]** Menu (3-2-1-1-1) you see the raw data for that moment.

Monitor the values in the *Progress* display;
- Detect temperature is the temperature of the detection block.
- The Tcc is the value of the Detector 2 minus Detector 1 plus the temperature correction and must be in a range 60-200.

9.3.4. Calibration of 50 ppB value

For this calibration you need the container with the 50 ppB solution.
Take the bottle adapter out of the container what holds the 500 ppB solution and put this in the bottle with the 50 ppB solution.
Select **[50 ppB]** Menu (3-2-1-2). In **[Progress 50 ppB]** Menu (3-2-1-2-1) you see the raw data for that moment.

Monitor the values in the *Progress* display;

- Detect temperature is the temperature
- Detector 1 must be in the range of 100 till 200 mV
- The Tcc is the 200 ±20% of the value Detector-1.

The value of Tcc can more or less be checked by subtracts Detector 2 and Detector 1. This gives you in indication of the acceptation of the value.
The duration of the calibration will take a minim of 20 minutes.
The calibration is correct if the reading is a stable.

9.3.5. Calibration of 500 ppB value

Make sure the bottle adapter is in the container with the 500 ppB solution.
Select [**500 ppB]** Menu(3-2-1-3). In **[Progress 500 ppB]** Menu (3-2-1-3-1) you see the raw data for that moment.

Monitor the values in the *Progress* display;

- Detect temperature is the temperature of the detection block.
- Detector 1 must be in the range of 100 till 200 mV
- The Tcc is the 800 ±20% of the value Detector-1.

The value of Tcc can more or less be checked by subtracts Detector 2 and Detector 1. This gives you in indication of the acceptation of the value.
The duration of the calibration will take a minim of 20 minutes.
The calibration is correct if the reading is a stable.

9.4. Measurement start

If all the calibration values are stored in memory you can start the measure sequence. Set your **[Measure period]** Menu (4-1-2) to desired period. The instrument is collecting data every second and calculates the average over the set period of time (selectable from 1 till 99 minutes). This calculated time average is stored in memory.

Press **<ESC>** key until you are returned in the mean menu.
Press *Measure* Menu (1) and the instrument starts to measure.
The air pump and the syringe pump are running, the data is stored in the data memory.
When you press key **<1>** you come automatically in the data view displays. Toggle through the menus to select the desired data display by using the F2 and or F3 key.

9.5. Measurement stop

To stop the measurement press the **<ESC>** key and return to the *manual* mode. Switch off the **[Air pump]** Menu (2-1), the **[Syringe pump]** Menu (2-2-1) and select the *pump on/off*.

Be aware after you stop the flow in the instrument for some time the instrument can generate errors on the Detector and temperature sensors.
You can reset this errors via the menu **[Settings/Service]** in the menu **[Clear errors]** Menu(4-2-3).

9.6. Setting / Service

In this section the setting and the service mode of the instrument.
In the **[Settings]** Menu (4-1) the following changes or settings can be altered:

- Data and time
- Measure period
- Clear the memory
    - More options
    - Running mean/min
    - Auto start
    - Logging on/off
        - More options
        - Fan on/off
        - Baud rate

In the **[Service]** Menu (4-2) the following service are available:

- Status
- Errors
- Clear errors
- Software version

9.6.1. Settings

[Date and time] Menu (4-1-1)
Set the correct date and time or alter the date or time. When changing one of the settings, you have to continue to fill in the date until the last setting input.

[Measure period] Menu (4-1-2)
Set time period, selectable from 01 till 99 minutes. The instrument is collecting data every second and calculates the average over that set time period and stored the calculated time average is memory.

[Clear the memory] Menu (4-1-3)
Clear the memory. All collected data is cleared and the last stored calibration values are restored. A maximum of 99 Calibration values are stored in the memory. After clear memory the last calibration is restored as number 1 in the calibration list.

[More options] Menu (4-1-4)
The following settings can be made or select.

[Running mean/min] Menu (4-1-4-1)
Set period of time, selectable from 0.5 till 60 min.

[Auto start] Menu (4-1-4-2)
Is a future to restart after a power failure, is selectable *Auto start* yes or no. This setting is stored in memory

[Logging on/off]. Menu (4-1-4-3)
Select logging data on or off.

[More options] Menu (4-1-4-4)
The following settings can be made or select.

[Fan On /Off] Menu (4-1-4-4-1)
Is by default on and can be switch off. This setting is stored in memory.

[Baud rate] Menu (4-1-4-4-2)
Is selectable 4800, 9600, 19200 with fixed parameters 8-n-1.

9.6.2. Service

[Status] Menu (4-2-1) is not available.

[Errors] Menu (4-2-2) is not available.

[Clear errors] Menu (4-2-3) you press **<3>** this will cancel the error or alarm of the instrument.

[Software version] Menu (4-2-4)

10. SYSTEM MESSAGES

10.1. System messages

The system gives two types of messages, the system and the error messages

System list

System number	System description
NN	Not available yet

10.2. Error messages

Error list

Error number	Error description
Error 1	**Bottle empty or waste full**
Error 2	Temperature out of range
Error 3	Detector I out of range
Error 4	Detector II out of range
Error 5	Data Memory full
Error 6	3 point calibration Memory full

Table 2 Error list

11. MAINTENANCE

The instrument needs maintenance to keep the instrument in top condition. On this moment there is not enough flied information available to set-up a maintenance schedule. We recommend the following schedule for this moment.

11.1. Maintenance time schedule

The following schedule can be set-up for the maintenance.

Running Hours	Description of the maintenance
<150	1 week period
1500	2 month period
2100	3 month period
4500	6 month period
8500	12 month period

Table 3 Maintenance schedule

11.1.1. <150 hour

- Down load the data
- Replace the regents
- Clean the waste bottle
- Check the calibration values
- Run a calibration check

11.1.2. 1500 hour

Clean the cyclone pot of the sample block with De-mineralised water

11.1.3. 2100 hour

1500 hour maintenance plus:

- Replace the syringe which pumps the lye if needed.
  Part number AMIN030149

11.1.4. 4500 hour

2100 hour maintenance plus:

Replace the Teflon tips in the syringe	QWLV030006, QWL030007
or replace the old syringe by new ones.	AMIN030149, AMIN030150
Replace the air pump	AMIN040130
Replace the disk filter	QWLV040001
Replace the membrane of the detection block	AMIN010015
Replace the membrane of the sample block	AMIN020010

11.1.5. 8500 hour

Is the 4500 hour maintenance

The Master flow controller has no maintenance or calibration schedule

12. DATA MANAGEMENT

The AiRRmonia has a standard RS232 date communication with default settings of 19200-8-n-1.
The data is storage in E-Eprom.
The data is standard ACII format and is readable in any communication software such as ProComm or Hyper Terminal. The connection cable between the Instrument and the PC is a standard 9 to 9 pin 1 in 1 computer cable, what can be obtained in any PC shop.

12.1. RS232 connection

The data string is in ACII format. Data is sending every 1-second to the serial output. Set-up your communication parameters to 19200 Baud, 8 charters, no party bit and 1 stop bit. See also your software instructions of the communications software

12.2. Data storage

The data is held in instrument E-Eprom with storage capacitates of 512 Kbytes.
This data memory can hold more then a 32,000 samples.
An example:
One samples every minute x 60 x 24 hours x 7 days that makes 10,080 samples.

12.3. Down load data

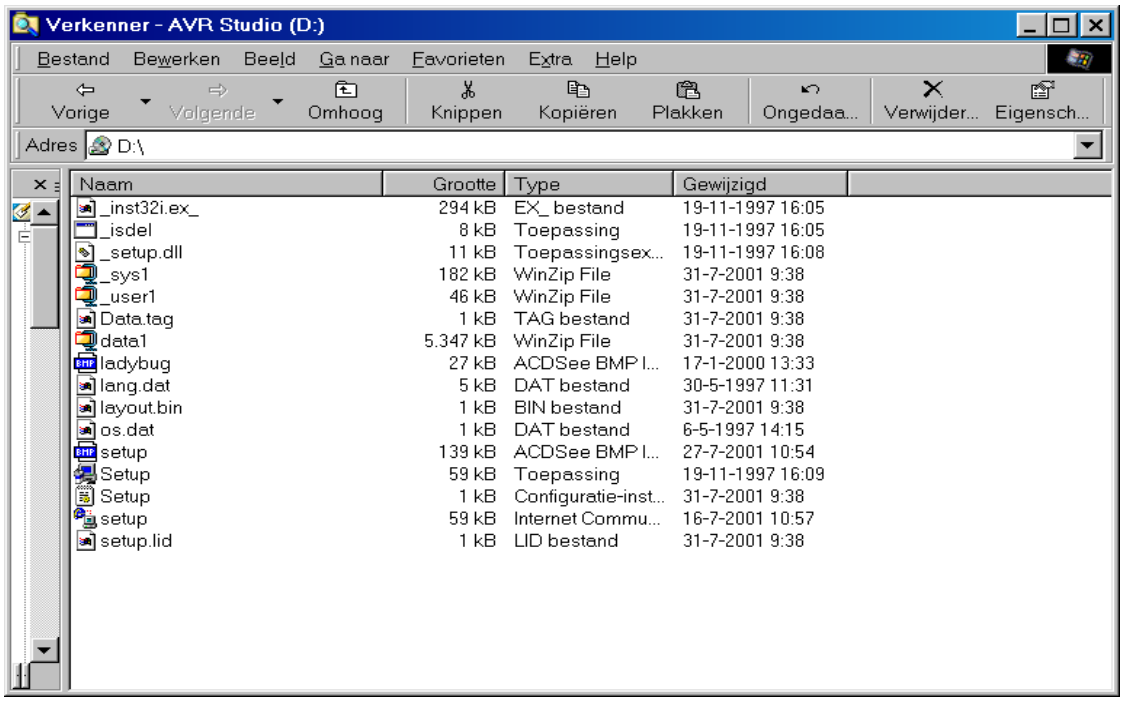
Use communication software like ProComm for download the data. Set the correct parameters in the set up file and download the data **into a file**. The down load time from 10.000 samples takes about 6 minutes with a communication speed of 19200 baud. The instrument is during the download period offline.
To start the download sequence from AiRRmonia to Host PC use the key combination **[ESC]** and the capital letter < **Y** >.
When the data is down loaded from the instrument into the PC, the keyboard is frozen and the instrument does not collecting data.
See for more key combination Appendix **Control Commandos**.

12.4. Process the data

The data file can be import and processed in Excel by using the import wizard. To change the time and data format select the whole column, go to format cell and select date in the format of the date time. This will do the trick.

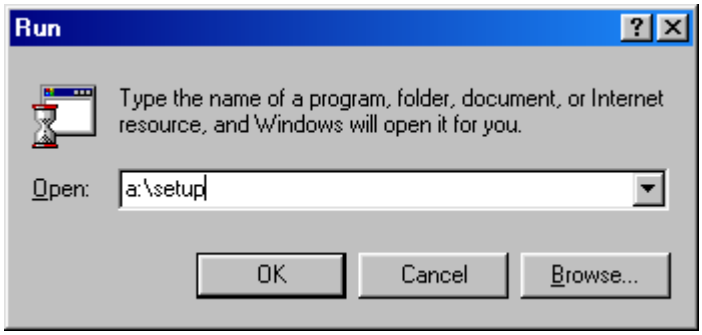
13. UPLOAD NEW SOFTWARE

The AiRRmonia is software controlled.
The new software can be up-dated by using a micro controller flash program to upload the software in the memory of the AiRRmonia. (The software program can be ordered by Mechatronics **QEPC079001**).
The AVR CD contains the following files.


Verkenner - AVR Studio (D:)
Bestand Bewerken Beeld Ga naar Favorieten Extra Help
Vorige Volgende Omhoog Knippen Kopiëren Plakken Ongedaa... Verwijder... Eigensch...
Adres D:\
Naam Grootte Type Gewijzigd
inst32i.ex 294 kB EX_ bestand 19-11-1997 16:05
_isdel 8 kB Toepassing 19-11-1997 16:05
_setup.dll 11 kB Toepassingsex... 19-11-1997 16:08
_sys1 182 kB WinZip File 31-7-2001 9:38
_user1 46 kB WinZip File 31-7-2001 9:38
Data.tag 1 kB TAG bestand 31-7-2001 9:38
data1 5.347 kB WinZip File 31-7-2001 9:38
ladybug 27 kB ACDSee BMP I... 17-1-2000 13:33
lang.dat 5 kB DAT bestand 30-5-1997 11:31
layout.bin 1 kB BIN bestand 31-7-2001 9:38
os.dat 1 kB DAT bestand 6-5-1997 14:15
setup 139 kB ACDSee BMP I... 27-7-2001 10:54
Setup 59 kB Toepassing 19-11-1997 16:09
Setup 1 kB Configuratie-inst... 31-7-2001 9:38
setup 59 kB Internet Commu... 16-7-2001 10:57
setup.lid 1 kB LID bestand 31-7-2001 9:38

13.1. Install the download software

This software must be installed on a PC. Insert the CD in the CD drive and select the set-up program of the CD. See for details your manual how to operate Windows. The set-up program will install the software via the installation wizard. Follow the wizard instructions.
After the installation the software and restart your PC the software is ready for use.


Run
Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Open: a:\setup
OK
Cancel
Browse...

13.2. Install the interface

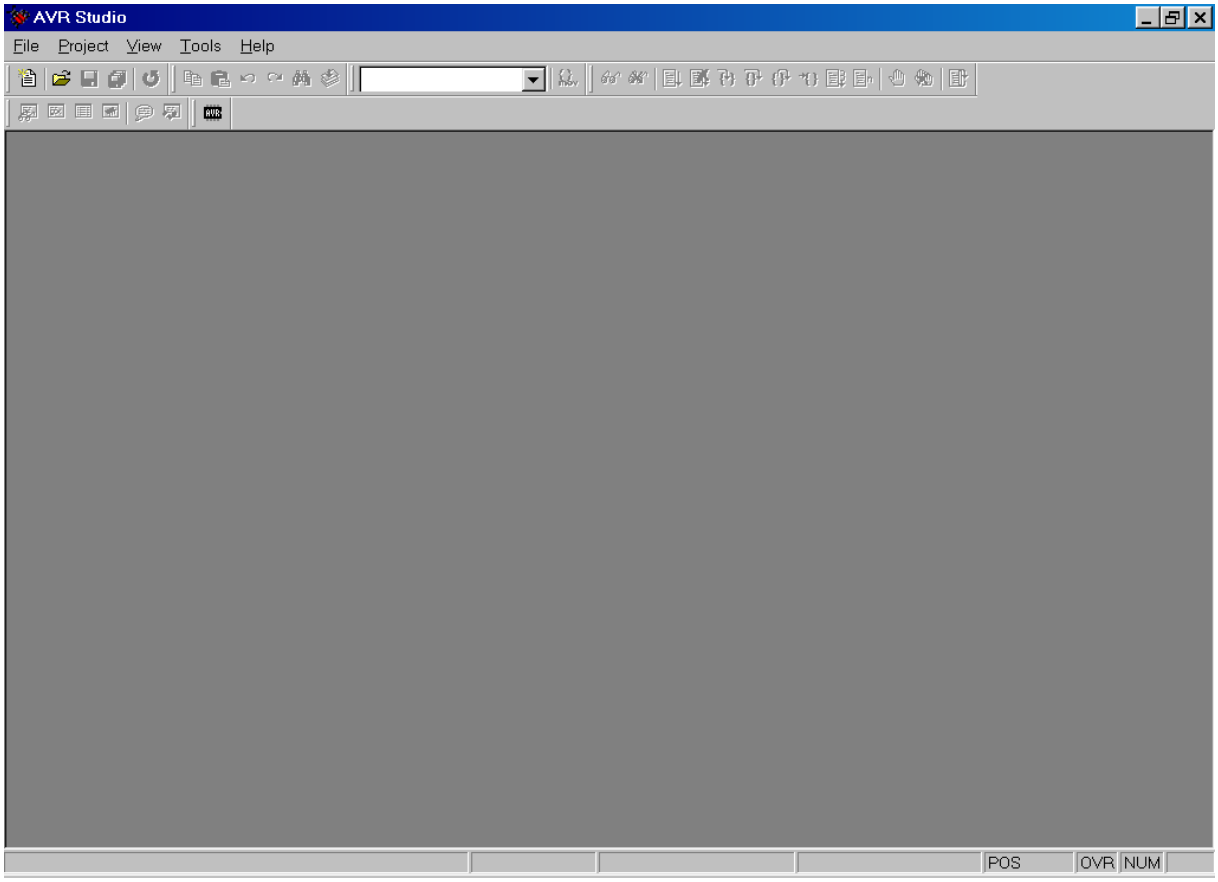
Install the interface with the serial cable to one of the serial ports of your computer.

13.3. Connect the interface to the PC board.

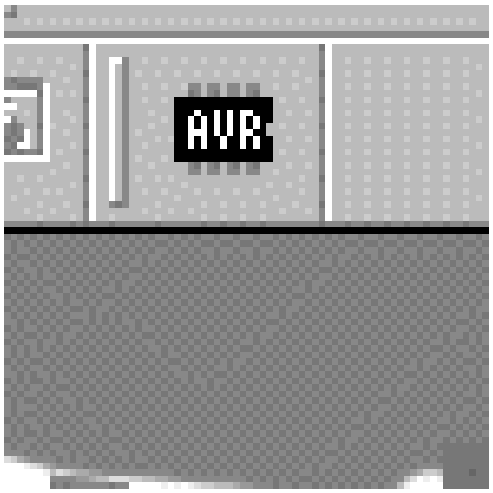
Connect the flat cable from the interface to the PC board in connector J12. This connector is located direct under the microprocessor.

13.4. Run the upload software

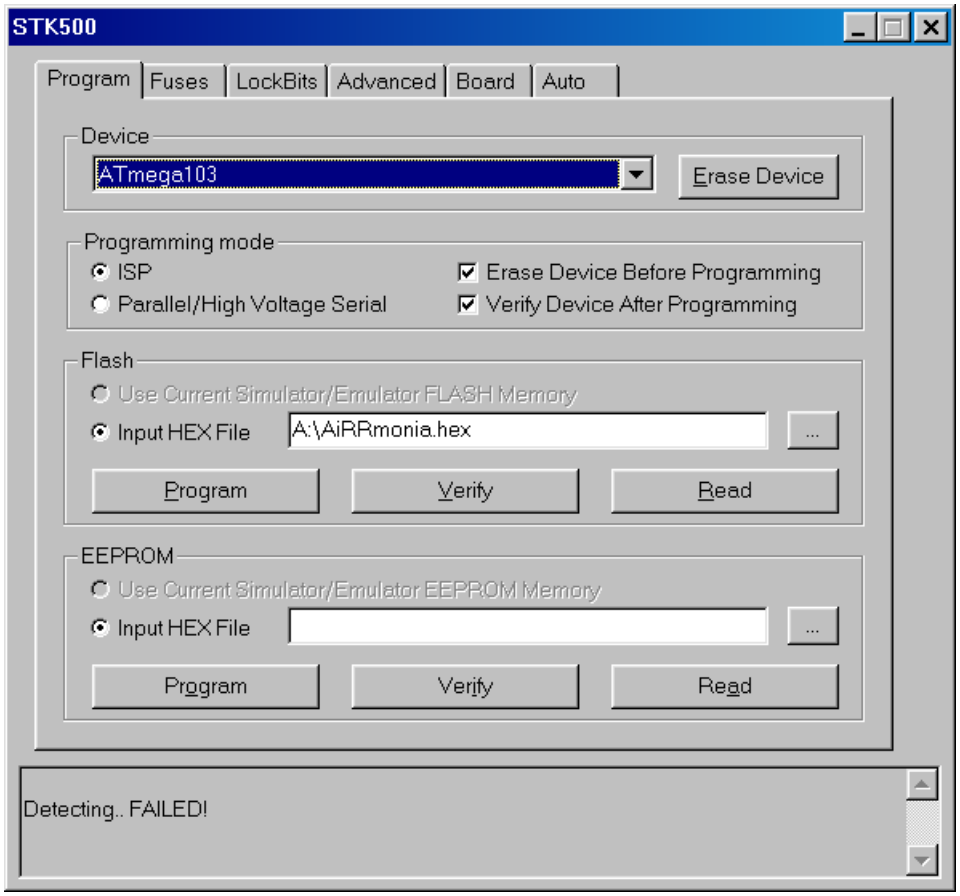
Click on the **Start** Icon in the Window Icon bar at the bottom of the screen, go to program and click on the Icon **AMTELAVR Tools,** click on the **AVR studio** Icon and the program will start and show the following screen**.**



Select in the main task balk the Icon AVR.

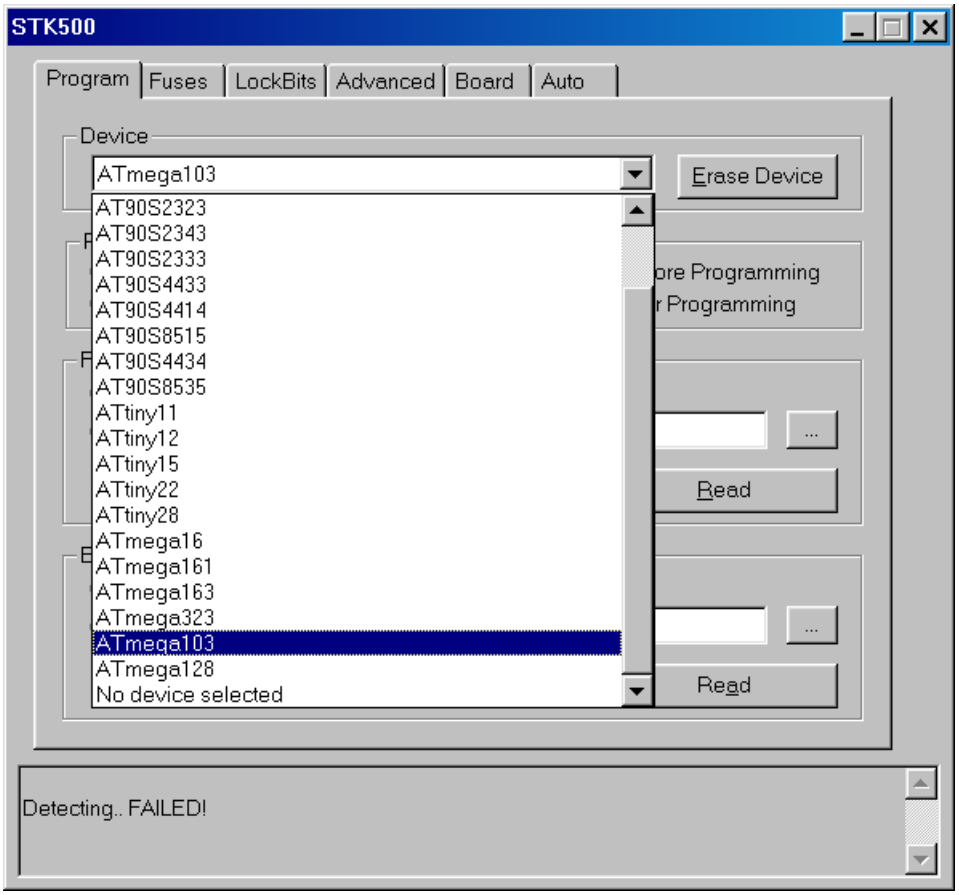


The program responds with the next screen



Check the following windows;

Select in the **Device** window the Atmega103/L

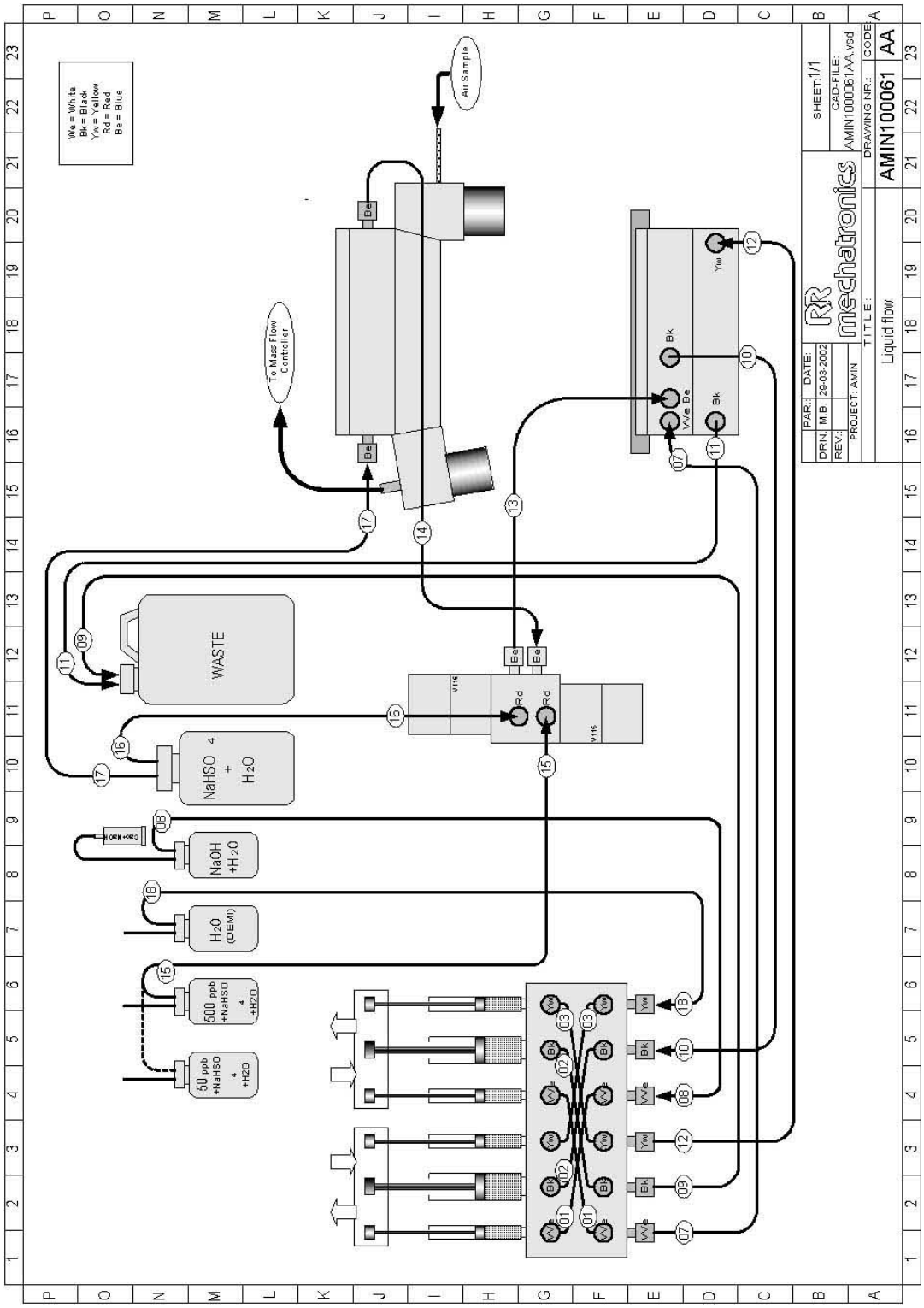


Load the AiRRmonia program file into window **FLASH.** Use the select button and select the program hex file. This file can be on your hard disk or on floppy.

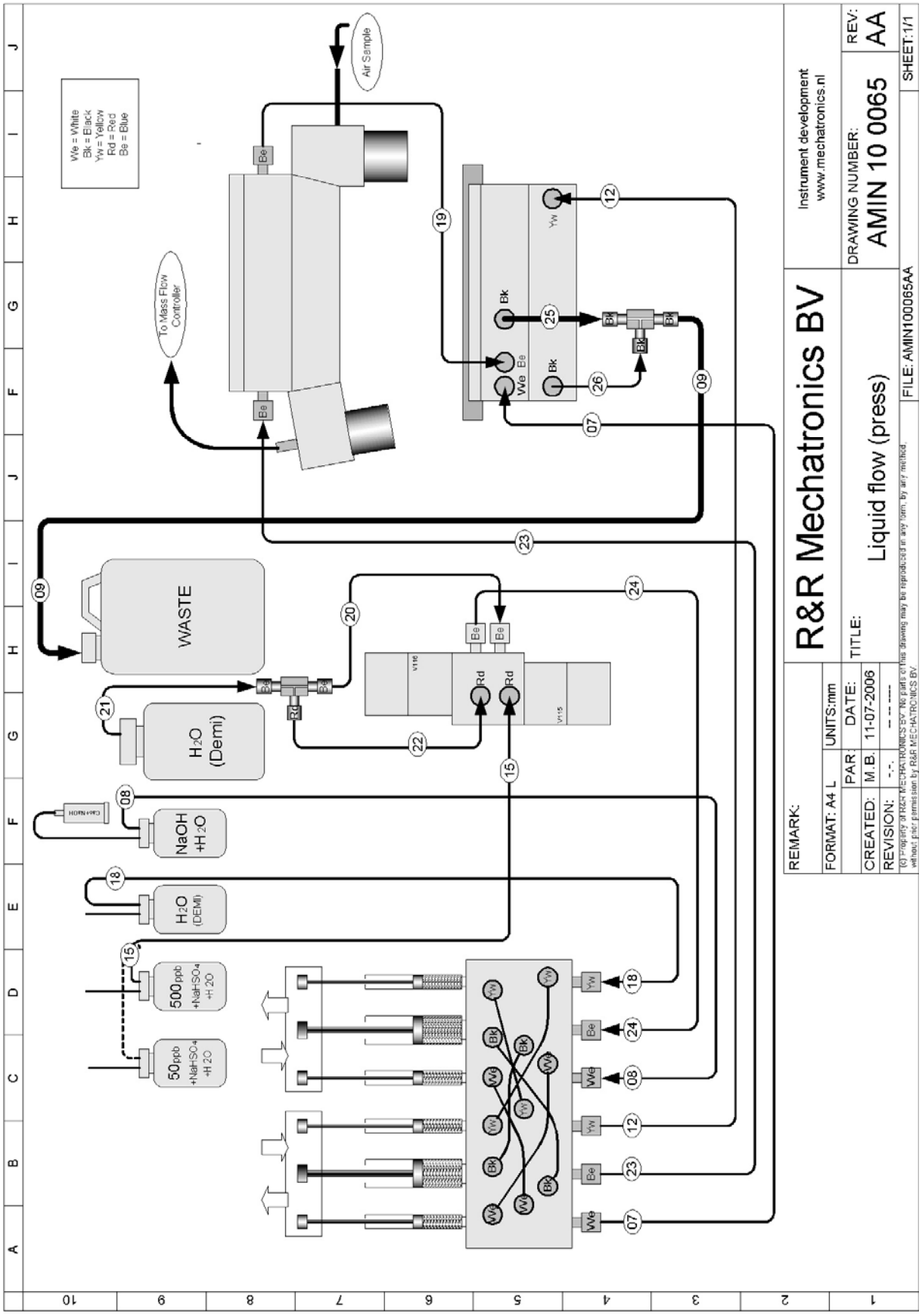
Check in the window **Programming mode** that the option **Erase device before programming** and **Verify device after programming** is set.
Press the key **<Program>**

14. DRAWINGS

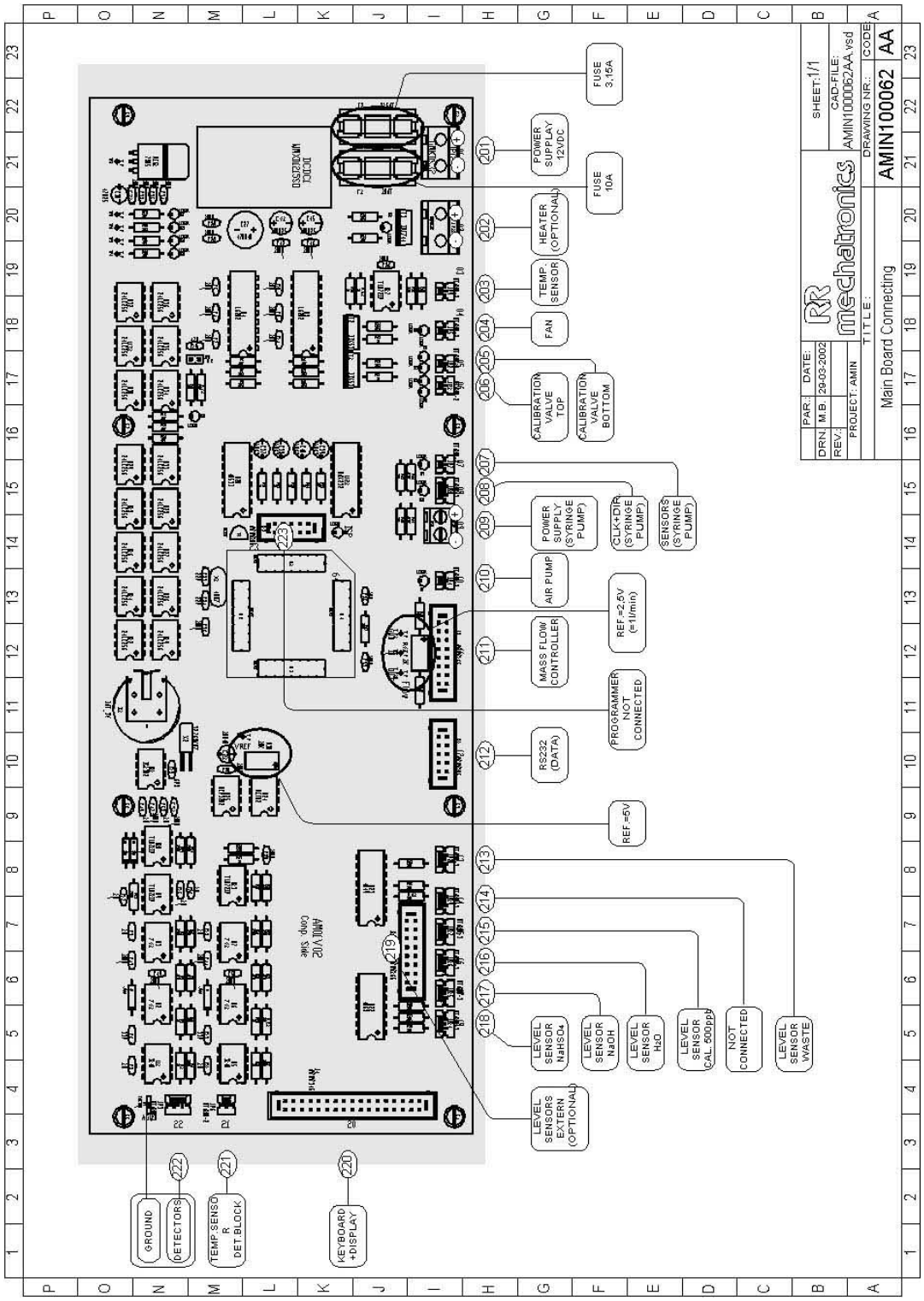
14.1. Liquid flow



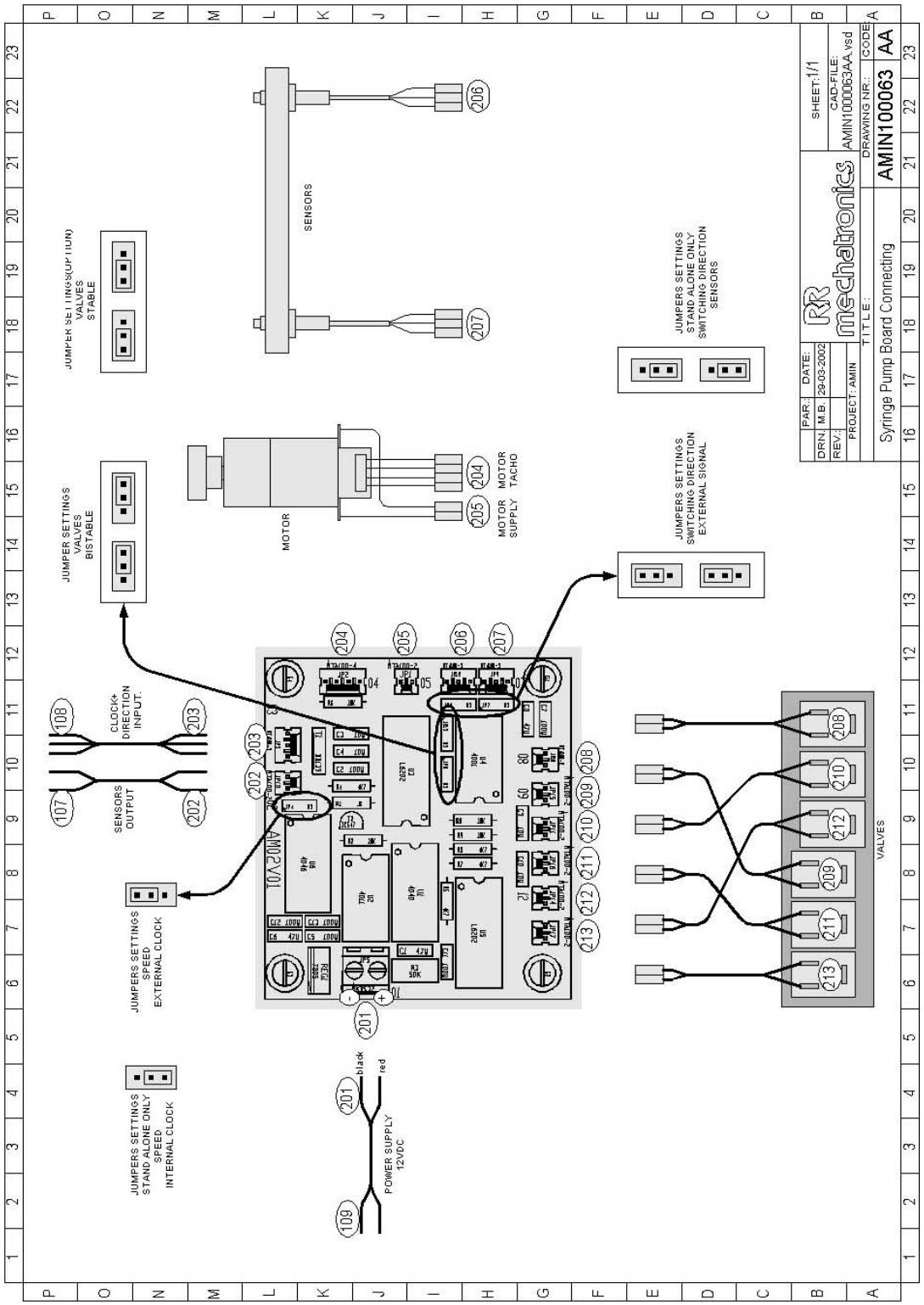
14.2. Liquid flow (press)



14.3. Connectors on the computer board



14.4. Motor and valve PC Control board.



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15. APPENDIX SECTION OF MRN-053 AIRRMONIA

Appendix A - Connectors
Appendix B - Control Commands
Appendix C - AiRRmonia string format
Appendix D - Measure principal
Appendix E - Menu structure
Appendix F - Flow Diagram

APPENDIX A - CONNECTORS

DC power socket

Pin No.	Function
	+12V DC (Brown)
	0V (Blue)

APPENDIX B - PC serial DATA CABLE for down load the data

Wiring diagram for a 9 pin 1 to 1 cable.

Pin No. Male	Signal name	Information	Pin No Female
1	DCD	Data carrier detect	1
2	RxD	Received data	2
3	TxD	Transmit data	3
4	DTR	Data terminal ready	4
5	GND	Ground	5
6	DSR	Data set ready	6
7	RTS	Request data to send	7
8	CTS	Clear to send	8
9	RI	Ring indicator	9

Down load cable for the software

Is a special cable with dongle and interface is needed for upload new software in the instrument computer.

APPENDIX C - Control Commands.

AiRRmonia Protocol RS232

Commandos: Host ⇒ AiRRmonia

GetStatus	**Esc ?**	Return status (hexadecimal value)
GetDate	**Esc D**	Get date and time
GetMode	**Esc M**	Get mode status
GetPeriod	**Esc P**	Get measure period
GetLogging	**Esc L**	Get data logging setting
StartMeasure	**Esc E**	Set Measure mode
GetCalData	**Esc X**	Get calibration data
GetData	**Esc Y**	Get data

Software V1.12

ClearMem	**Esc C**	Clear memory (Calibration and measurement data is cleared)
GetSamples	**Esc N**	Get number of samples stored in memory

Software V1.13

GetAirPump	**Esc A**	Get air pump setting
GetLiqPump	**Esc Q**	Get syringe pump setting
GetValve	**Esc V**	Get valve setting
GetFan	**Esc F**	Get fan setting
GetHeater	**Esc H**	Get heater setting
GetInfo	**Esc I**	Get software version
ClearError	**Esc !**	Clear error flag + bottle error
StopMeasure	**Esc S**	Stops air pump + syringe pump
GetCal1	**Esc 1**	Get calibration 1 (0 ppB) result
GetCal2	**Esc 2**	Get calibration 2 (50 ppB) result
GetCal3	**Esc 3**	Get calibration 3 (500 ppB) result
Reset		Resets AiRRmonia (see **Change settings**)

Esc = Escape (ASCII 27; HyperTerminal = “Escape” key)

Data returned: AiRRmonia ⇒ Host

GetStatus	?xxxx<CR><LF>	Hexadecimal value (see **Status bits**)
GetDate	Ddd-mm-yyyy hh:mm<CR><LF>	D01-01-2001 12:00
GetMode	Mx<CR><LF>	1= Measure 2= Calibration
GetPeriod	Pxx<CR><LF>	xx = 01 till 99 (minutes)
GetLogging	Lx<CR><LF>	0 = Logging OFF 1 = Logging ON
StartMeasure	E<CR><LF>	Confirmation!
GetCalData	Xdata<CR><LF>	See appendix E for string format
GetData	Ydata<CR><LF>	See appendix D for string format

Software V1.12

ClearMem	C<CR><LF>	Confirmation!
GetSamples	Nsamples<CR><LF>	Number of samples (length variable!)

Software V1.13

GetAirPump	Ax<CR><LF>	0 = Air pump OFF 1 = Air pump ON
GetLiqPump	Qx<CR><LF>	0 = Syringe pump OFF 1 = Syringe pump ON
GetValve	Vx<CR><LF>	0 = Measure valve 1 = Calibration 1 valve 2 = Calibration 2 valve
GetFan	Fx<CR><LF>	0 = Fan OFF 1 = Fan ON
GetHeater	Hx<CR><LF>	0 = Heater OFF 1 = Heater ON
GetInfo	I Vx.xx<CR><LF>	Vx.xx = software version
ClearError	! <CR><LF>	Confirmation!
StopMeasure	S<CR><LF>	Confirmation!
GetCal1	1:xxxx<CR><LF>	xxxx = 0000 till 9999
GetCal2	2:xxxx<CR><LF>	xxxx = 0000 till 9999
GetCal3	3:xxxx<CR><LF>	xxxx = 0000 till 9999
Reset	R<CR><LF>	Confirmation!

<CR> = Carriage Return (ASCII 13)
<LF> = Line Feed (ASCII 10)

Status bits	
0 = Air pump	Example: “?001E”
1 = Syringe pump	
2 = Fan	Air pump = OFF
3 = Heater	Syringe pump = ON
4 = Auto start	Fan = ON
5 = Error flag	Heater = ON
6 = Bottle	Auto start = ON
7 = Data memory	
8 = Calibration memory	

Change settings: Host ⇒ AiRRmonia

Software V1.13

Reset	<STX>R<CR>	Reset AiRRmonia!
SetAirPump	<STX>Ax<CR>	0 = Air pump OFF 1 = Air pump ON
SetLiqPump	<STX>Qx<CR>	0 = Syringe pump OFF 1 = Syringe pump ON
SetValve	<STX>Vx<CR>	0 = Measure valve 1 = Calibration 1 valve 2 = Calibration 2 valve
SetLogging	<STX>Lx<CR>	0 = Logging OFF 1 = Logging ON
SetFan	<STX>Fx<CR>	0 = Fan OFF 1 = Fan ON
SetHeater	<STX>Hx<CR>	0 = Heater OFF 1 = Heater ON
SetPeriod	<STX>Px<CR>	xx = 01 till 99 (minutes)
SetCal1	<STX>1xxxx<CR>	xxxx = 0000 till 9999
SetCal2	<STX>2xxxx<CR>	xxxx = 0000 till 9999
SetCal3	<STX>3xxxx<CR>	xxxx = 0000 till 9999
SetDate	<STX>Ddd-mm-yyyy hh:mm<CR>	D01-01-2001 12:00

<STX> = Start of Text (ASCII 2 ; HyperTerminal = “Ctrl + b” keys)
<CR> = Carriage Return (ASCII 13; HyperTerminal = “Enter” key)

The AiRRmonia will respond with sending the new setting (see **Data returned**).

APPENDIX D - AiRRmonia data string format.

Normal format … 67 chars incl. crlf
Y;JJJJJ.jjjjj;PP;M;CC;EEEE;TTTT;fff;sssss;SSSSS;-tttt;-0NH4;-0NH3<cr><lf>

<EOT> is send after the last result.

Example …
Y;37106.87032;01;1;01;0002;2766;104;01474;12231;08613;02418;01972

Norm	Elements & details	
Y	Start of String	
JJJJJ.jjjjj	Time and date in 1900 format	Excel format
PP	PP = Measure period in minutes	01 till 99
M	M = status bit	1= Measure 2= calibration
CC	Calibration number	00 till 99
EEEE	Status bit	See **Status bits**
TTTT	TTTT = detected temperature in C^o	C^o / 100
Fff	Fff = airflow	L/min / 100
Sssss	Sssss = mV of Detector 1	mV / 10
SSSSS	SSSSS= mV of Detector 2	mV / 10
-tttt	Ttttt = temperature correct conductivity	mV / 10
-0NH4	NH4 = calculated resulted	ppB / 10
-0NH3	NH3 = calculated resulted	µgr/m^3 /100
CR	CR = carriage return	
LF	LF = Line feed	

Table 4 Data string information

<CR> = Carriage Return (ASCII 13)
<LF> = Line Feed (ASCII 10)
<EOT> = End of Transmission (ASCII 4)

Note:
Transmission can be stopped by sending: <Esc><Esc>

APPENDIX E - Calibration format string to the AiRRmonia.

Normal format … 51 chars incl. Crlf
X;CC;JJJJJ.jjjjj;Coco;Ccccc;COco;CCccc;COCo;CCCcc<cr><lf>

<EOT> is send after the last calibration.

Example …
X;01;36526.50000;0000;00834;0050;02638;0500;10371

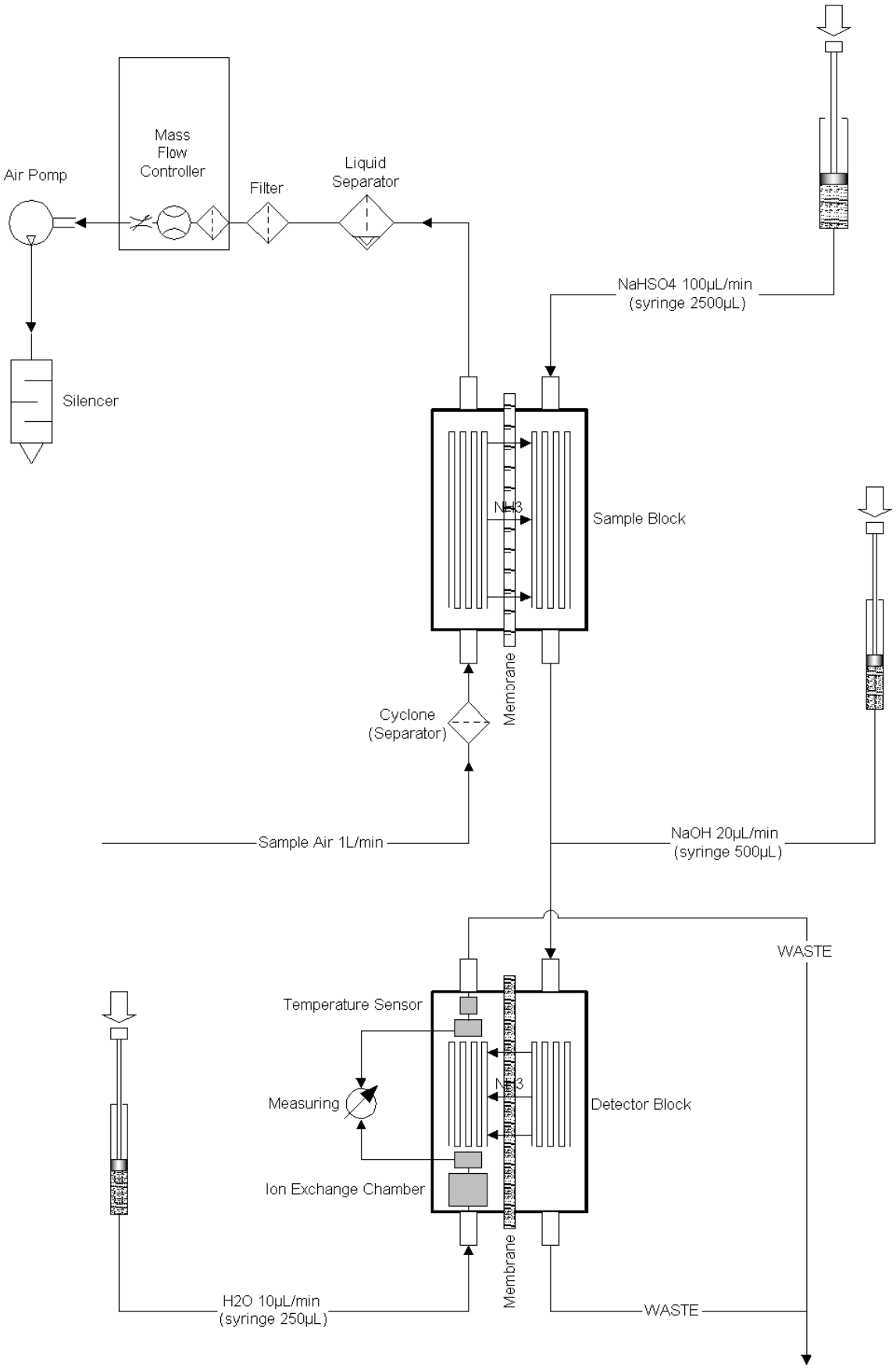
Norm	Elements & details	
X	Start of String	
CC	Calibration number	00 till 99
JJJJJ.jjjjj	Time and date in 1900 format	Excel format
Coco	Cal.Opl 1	ppB
Ccccc	Cond.cal 1	mV / 10
COco	Cal.Opl 2	PpB
CCccc	Cond.cal 2	mV / 10
COCo	Cal.Opl 3	PpB
CCCcc	Cond.cal 3	mV / 10
CR	CR = carriage return	
LF	LF = Line feed	

Table 5 Calibration string information

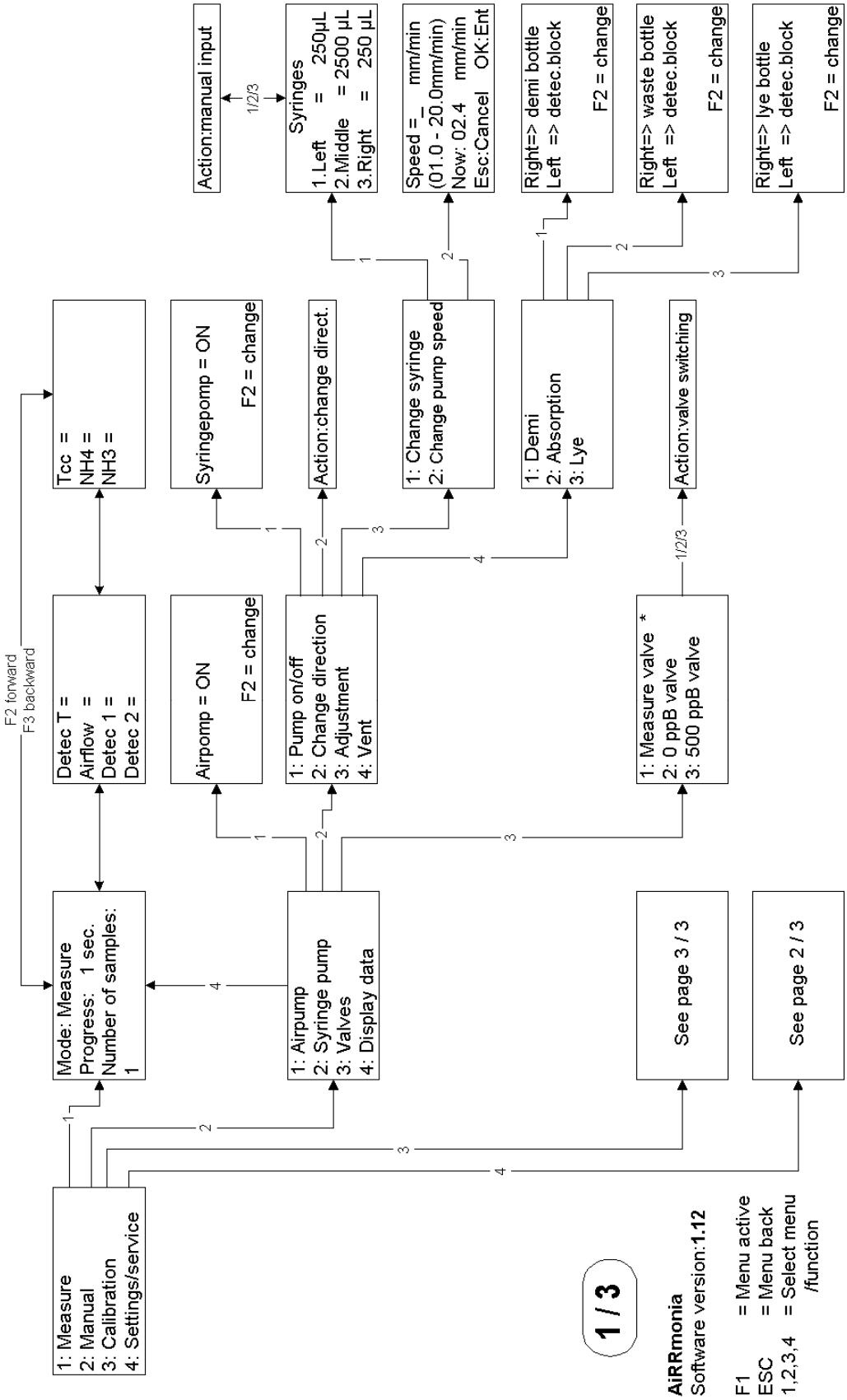
<CR> = Carriage Return (ASCII 13)
<LF> = Line Feed (ASCII 10)
<EOT> = End of Transmission (ASCII 4)

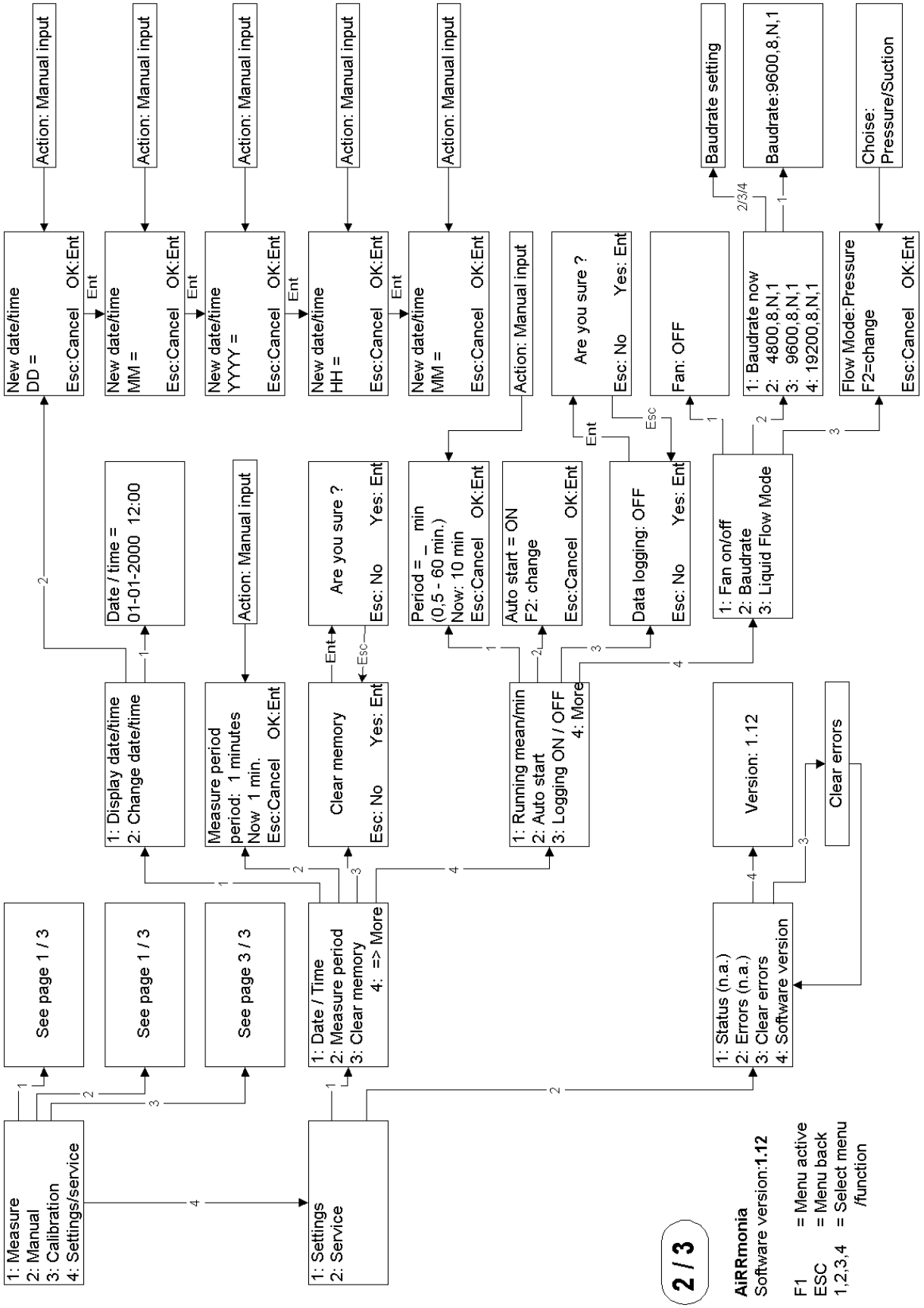
Note:
A maximum of 99 Calibration values are stored in the memory. After clear memory the last calibration is restored as number 1 in the list.

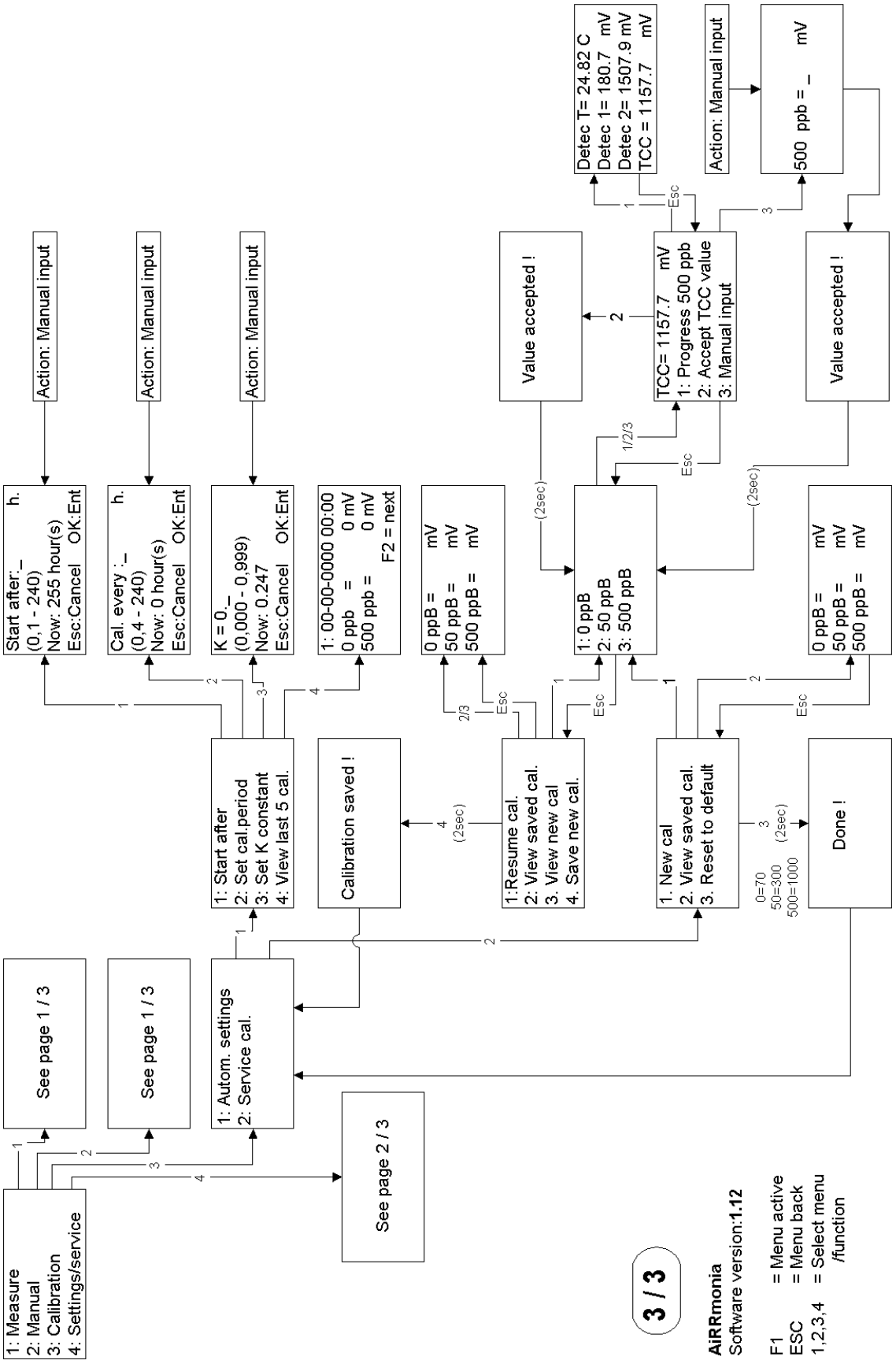
APPENDIX F - Measure principal



APPENDIX G - Menu structure page 1, 2 and 3




1: Measure
2: Manual
3: Calibration
4: Settings/service
See page 1 / 3
See page 1 / 3
See page 3 / 3
1: Settings
2: Service
1: Date / Time
2: Measure period
3: Clear memory
4: => More
1: Display date/time
2: Change date/time
Date / time =
01-01-2000 12:00
New date/time
DD =
Esc:Cancel OK:Ent
New date/time
MM =
Esc:Cancel OK:Ent
New date/time
YYYY =
Esc:Cancel OK:Ent
Action: Manual input
Measure period
period: 1 minutes
Now 1 min.
Esc:Cancel OK:Ent
Clear memory
Esc: No Yes: Ent
Are you sure ?
Esc: No Yes: Ent
Ent
Esc
1: Running mean/min
2: Auto start
3: Logging ON / OFF
4: More
New date/time
HH =
Esc:Cancel OK:Ent
New date/time
MM =
Esc:Cancel OK:Ent
Period = _ min
(0,5 - 60 min.)
Now: 10 min
Esc:Cancel OK:Ent
Auto start = ON
F2: change
Esc:Cancel OK:Ent
Data logging: OFF
Esc: No Yes: Ent
Are you sure ?
Esc: No Yes: Ent
Fan: OFF
1: Fan on/off
2: Baudrate
3: Liquid Flow Mode
1: Baudrate now
2: 4800,8,N,1
3: 9600,8,N,1
4: 19200,8,N,1
Baudrate setting
Baudrate:9600,8,N,1
Flow Mode:Pressure
F2=change
Esc:Cancel OK:Ent
Choise:
Pressure/Suction
1: Status (n.a.)
2: Errors (n.a.)
3: Clear errors
4: Software version
Version: 1.12
Clear errors
2/3/4
2 / 3
AiRRmonia
Software version:1.12
F1 = Menu active
ESC = Menu back
1,2,3,4 = Select menu /function


1: Measure
2: Manual
3: Calibration
4: Settings/service
See page 1 / 3
See page 1 / 3
See page 2 / 3
1: Autom. settings
2: Service cal.
1: Start after
2: Set cal.period
3: Set K constant
4: View last 5 cal.
Start after:_ h.
(0,1 - 240)
Now: 255 hour(s)
Esc:Cancel OK:Ent
Cal. every :_ h.
(0,4 - 240)
Now: 0 hour(s)
Esc:Cancel OK:Ent
K = 0._
(0,000 - 0,999)
Now: 0.247
Esc:Cancel OK:Ent
1: 00-00-0000 00:00
0 ppb = 0 mV
500 ppb = 0 mV
F2 = next
Action: Manual input
Action: Manual input
Action: Manual input
Calibration saved !
1:Resume cal.
2: View saved cal.
3. View new cal
4. Save new cal.
0 ppB = mV
50 ppB = mV
500 ppB = mV
1: 0 ppB
2: 50 ppB
3: 500 ppB
Value accepted !
TCC= 1157.7 mV
1: Progress 500 ppb
2: Accept TCC value
3: Manual input
Detec T= 24.82 C
Detec 1= 180.7 mV
Detec 2= 1507.9 mV
TCC = 1157.7 mV
Action: Manual input
500 ppb = _ mV
Value accepted !
1. New cal
2. View saved cal.
3. Reset to default
0 ppB = mV
50 ppB = mV
500 ppB = mV
Done !
0=70
50=300
500=1000
(2sec)
Esc
1/2/3
2/3
3 / 3
AiRRmonia
Software version:1.12
F1 = Menu active
ESC = Menu back
1,2,3,4 = Select menu /function

ALPHABETICAL INDEX

5

50 ppB 32, 33
500 ppB 16, 32, 33

A

Accessories 14
ACII format 41
air bubbles ..... 15, XXIX
air inlet 15
air pump 30, 34
airflow 30, 56
AiRRmonia 11
auto start 36

B

Baudrate 36
blanco 32
bottle connectors 15

C

calibration 16, 32, 33
calibration liquid 16
Clear error 34, 35, 37
Clear memory 36, 55, 56
CO2 filter 14
Commandos 41, 55
communication software 41
compress phase 27
conductivity 11
cross over movement 23, 26

D

Detector ..... 11, XXIX, 30, 33, 38, 56
Detector sample block 24
detector sensor 22, 23, 24
Dimensions 13
download period 41

E

E-Eprom 13, 41
Excel 42, 56

F

filter 25, 26

G

Gas-phase ammonia 13
glass filters 22, 23

H

Host 41, 55

I

ion column 22

K

keyboard 11, 15, 41

L

logging 32, 33, 36

M

Master Register Number 2
Measure period 13, 34, 36, 56
Measurement start 34
Measurement stop 34
membrane 11, 14, 22, 23, 25, 26
memory 34, 36, 38, 41, 43, 56

O

Output RS- 232 13

P

pre set-up 15
Prepare the 50 ppB 16
ProComm 41

R

Real time data 13
resin 14, 22
RS232 ..... 41, 55

S

sample block 14, 23, 25, 26
sensor 22, 23, 24, 28, 34
storage 41
Storage 41
Store the regent 16
string 55
String 41, 57
sucking phase 27
syringe 14, 15, 22, 28
syringe pump ..... 27, XXIX, 34
syringe stroke 27

T

Teflon tips 28

temperature sensor 34
Tools 14

U

upload 43, 54
Upload tool 14

W

wast 11, 27, 38
Weight 13
Weight for the reagent 13